APPENDIX C

RESOURCE MONITORING TABLE

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The following table was in the FEIS in the Monitoring Appendix.

Element	Item	Location	Technique	Unit of Measure	Frequency and Duration	Remedial Action Trigger	Management Options
AIR QUALITY	Gaseous and particulate critical air pollutants	area-wide	air quality modeling and ambient air samples	$\mu g/m^3$ and parts per million concentrations as ($\mu g/m^3$)	hourly to 24 hr samples as per standards	predicted or measured exceedances of NAAQS and/or PSD increments by MDEQ	implement additional emission controls or operating limits
	Gaseous and particulate critical air pollutants	Birney/Ashland area	ambient air samples	$\mu g/m^3$ and parts per million concentrations as ($\mu g/m^3$)	hourly to 24 hr samples as per standards	before expanded development activity	implement additional emission controls or operating limits
	Gaseous and particulate critical air pollutants	area-wide	emission inventory	lbs/hr and tons/yr	annually	continuous	require submittal of annual reports
CLIMATE		areas affected by land disturbance	RAWS or COOP Stations	bulk precipitation	daily during the growing season	extremes affecting revegetation operations	
CULTURAL RESOURCES	Area of Critical Environmental Concern (ACECs)	area-wide	site inspection	site, surrounding area	annually	any noticeable trend indicating increased disturbance—natural or human-caused	increase frequency of monitoring to ensure ACEC values are not being impaired
	20% of National Register eligible sites	CBM emphasis area	site inspection	site, surrounding area	annually	impacts to sites from unauthorized uses affecting qualities that make sites eligible for listing on National Register of Historic Places	halt activity affecting eligible sites. Increase monitoring of nearby eligible sites. Evaluate damage to sites.
	random sample of 50 sites	CBM emphasis area	site inspection	site, surrounding area	annually	any noticeable trend indicating increased disturbance—natural or human-caused	increase frequency and number of sites monitored, if sites are being impacted by CBM-related activities. Evaluate damage to sites.

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HYDROLOGY	surface water quality and quantity	area-wide on major rivers or streams where management activities are occurring or expected to occur	standard USGS quantitative measurements of water quality, including but not limited to pH, electric conductivity (EC), water temperature, common ions (Na, Mg, Ca, K, HCO_3, CI, So_4), and discharge	standard quantitative measurements of water quality and quantity (i.e., mg/l, °C, µS/cm, cfs)	discharge measurements to be taken daily at designated U.S. Geological Survey locations, including but not limited to the Tongue River at the state line (Decker), Tongue River at Brandenburg bridge (Ashland), Powder River at the state line (Moorhead), and Powder River above Locate. Stream water quality samples will be taken monthly at these stations. This sampling frequency will continue until CBM production ceases.	exceedance of any parameter above the state of MT surface water quality standards, including sodium adsorption ratio (SAR), EC, or suspended sediments	report exceedance to MDEQ, who will determine if exceedance is because of natural (low flow) or human causes. If caused by CBM discharge, enforcement action will be taken and/or Montana Pollutant Discharge Elimination System permits modified.

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	groundwater quality and quantity	regional coal seam monitoring wells will be installed on sites 3 to 5 miles from outcrop lines. Monitoring wells also will be required on sites where activities are occurring or expected to occur. Abandoned exploration and CBM wells will be converted to monitoring wells as needed.	coal seam monitoring wells would be finished in coal seams expected to be developed for CBM. Standard USGS quantitative measurements of water quality and quantity would be used, including but not limited to pH, EC, water temperature, common ions (Na, Mg, Ca, K, HCO_3, CI, SO_4), and depth to water.	standard quantitative measurements of water quality and static water level (mg/l, °C, µS/cm, and feet to water, reported in hundredths of feet)	depth to water measurements will be made monthly for the first 3 years to establish baseline. Measurements will be made quarterly thereafter, unless a greater frequency is determined to be necessary. Water quality samples will be taken quarterly for the first 3 years to establish baseline and annually thereafter, unless a greater frequency is determined to be necessary. Monitoring will continue until at least 95% recovery of static water level has been achieved, or the end of CBM development, whichever is longer.;	a 5-foot decrease in static water level from seasonally adjusted mean static water level (determined during the first 3 years), or a significant shift in water quality from baseline conditions (determined from first 3 years of data) that impacts its beneficial use	if falling water levels are determined to be caused by CBM activity, operators must offer water well mitigation agreements to all landowners with wells in defined drawdown area (5 feet or greater drawdown) of their development. Hydrologic barriers, such as injection wells, may be an option in some cases to prevent drainage of Native American gas and water resources.

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	groundwater quality and quantity	alluvial groundwater would be monitored in stream valleys topographically down gradient from CBM surface discharge points	monitoring wells would be finished in the alluvium. Depth to water measurements and water quality parameters, including but not limited to pH, EC, water temperature, common ions (Na, Mg, Ca, K, HCO_3, CI, SO_4), and would be obtained.	standard quantitative measurements of water quality and static water level (mg/l, °C, µS/cm, and feet to water, reported in hundredths of feet)	depth to water measurements will be made monthly. Water quality samples will be taken quarterly. Monitoring will continue until at least 95% recovery of static water level has been achieved, or the end of CBM development in that drainage, whichever is longer.	if static groundwater levels are naturally greater than 10 feet below ground surface, a rise in static groundwater levels to 10 feet below ground surface will be the trigger. If natural static groundwater levels are between 10 and 5 feet of the surface, a 2-foot rise in water levels from seasonal baseline levels (determined from the first year of data) will be the trigger. If static groundwater levels are naturally within 5 feet of the surface, a 1-foot rise in water levels from seasonal baseline levels (determined from the first year of data) will be the trigger. A change in groundwater chemistry such that beneficial use of groundwater would be impacted, also will serve as a trigger.	if rises in groundwater levels are determined to result from CBM development, direct discharge of CBM water into waterways in watershed would cease until modified Water Management Plans (WMPs) are submitted and approved

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	groundwater quality and quantity	monitoring wells will be installed approximately 300 feet topographically downgradient from infiltration and evaporation impoundments	a nest of monitory wells will be installed with completions just above each aquatard, up to 100 feet total depth, to determine effectiveness of infiltration or if evaporation basins are leaking	depth to water (feet to water reported in hundredths of feet). Water quality samples may be collected as needed.	wells will be gauged monthly. Monitoring will continue at least 95% recovery of static water level has been achieved, or the end of CBM water discharge into the associated basins, whichever is longer.	a rise of 1-foot or more in static water levels above seasonally adjusted mean water levels (determined from the first year of data)	if the rise in water levels is determined to result from CBM activities, operators may be required to install additional monitoring wells further downgradient, or discharge into impoundments may be required to cease until a revised WMP is submitted and approved
	springs	a network of springs will be identified along coal outcrops in the CBM development area	spring discharge and water quality parameters, including but not limited to pH, EC, water temperature, common ions (Na, Mg, Ca, K, HCO_3, CI, SO_4), will be determined from existing springs	discharge (cfs), pH, EC (µS/cm), and water temperature (°C) will be determined in the field. Standard quantitative measurements of water quality also will be used (mg/l)	discharge, pH, EC, and water temperature will be determined quarterly. Water samples will be collected for analysis annually.	a 50% decrease in spring discharge below seasonally adjusted mean (determined in the first 3 years), or a significant change in water quality that affects its beneficial use, or a change in the spring ecosystem from functional to nonfunctional	if decreased spring discharges or water quality are determined to result from CBM activity, operators must offer spring mitigation agreements to landowners who use the spring. If impacted spring is identified as important wildlife habitat, adaptive management practices will be used at the landscape level to improve spring ecosystems. Hydrologic barriers, such as injection wells, may be an option in some cases to prevent drainage of Native American gas and water resources.

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INDIAN TRUST	groundwater	adjacent to the Northern Cheyenne and Crow reservations	sampling of dedicated monitoring wells in the zones of extraction and zones above and below the expected activity—wells are to be placed in the affected areas to areas unaffected by management activities	standard quantitative measurements of water quality—measurement of depth in feet	field measurements 6 times yearly prior to production activities, continue throughout the activity period and for the duration of 95% of the recovery of pre-development conditions	where site-specific studies show a potential to affect Reservation groundwater, the Tribe would be consulted as to appropriate protection measures and if continuous monitoring shows a drawdown of groundwater that is attributed to CBM production	BLM would require the operators to modify federal CBM production. Mitigation options may include reducing production rates, shutting in the well or wells, establishing a hydrologic barrier, or providing compensation to the affected Tribe.
			monitoring wells will be established near the mouth of streams that contain alluvium	measurements of depth in feet	water level measurements will be taken monthly prior to production activity and during the development - water quality measurements will be taken 4 times per year	a 20% rise in the water table above its seasonally adjusted elevation, or a 2 unit increase in the SAR value	Discontinuance of CBM evaporative ponds in that watershed, or require ponds to be lined
	natural gas	area-wide	drainage evaluation	radius of drainage	as needed	gas drainage	a communitization agreement, requiring operators to reduce production rates, shut-in wells, change spacing, or establish a hydrologic barrier to protect the Indian minerals from drainage

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LANDS AND REALTY	rights-of-way	area-wide	site inspection	right-of-way	minimum of once during or for construction within 2 years of issuance for MLA reviews and within 5 years of issuance for FLMPA reviews; then in the 20th year after issuance and every 10 years thereafter	nonuse of right-of-way or violation of right-of-way grant stipulations	require compliance with right-of-way grant stipulations with possible suspension and/or termination for noncompliance or nonuse
MINERALS **Oil and Gas**	Geophysical Notice of Intent (NOI)	area-wide	line or area inspection	operations conducted in compliance with NOI	minimum of once during operations	violation of regulations, change from approved Notice of Intent, unnecessary or undue degradation	require operator to follow NOI
	Geophysical Notice of Completion (NOC)	area-wide	line or area inspection	operations conducted in compliance with NOC	minimum of once during plugging, once after reclamation	violation of regulations, change from approved NOC unnecessary or undue degradation	require operator to correct violation
	Application for Permit to Drill (APD)	area-wide	site inspection	operations conducted in compliance with Application for Permit to Drill	minimum of once and as necessary	violation of regulations, change from approved Application for Permit to Drill	issue an incidence of noncompliance (INC) with timeframe to correct or shut-in drilling operations
	Sundry Notice	area-wide	site inspection	operations conducted in compliance with Sundry Notice	as necessary	violation of regulations, change from approved Sundry Notice unnecessary or undue degradation	issue an INC with timeframe to correct

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	natural gas	area-wide	drainage evaluation	radius of drainage	as needed	if gas drainage is occurring, there would be a communitization agreement, drilling of protective wells on federal lands, or different spacing, to protect the federal minerals from drainage	certified letter to lessee requiring protection, compensation royalty, relinquishment
	produced water disposal	area-wide	site inspection	operations conducted in compliance with permit	minimum of once annually or as necessary	violation of regulations, change from approved permit, unnecessary or undue degradation	issue an INC with timeframe to correct or shut-in operations
	spill	area-wide	site inspection	area cleaned up, reclaimed	minimum of once after event and as necessary	violation of regulations, change from approved permit, unnecessary or undue degradation	issue an INC and operator cleanup required
	plugged, abandoned wells	area-wide	site inspection	operations conducted in compliance with permit	minimum of once during operations	violation of regulations, change from approved permit, unnecessary or undue degradation	issue an INC correction required
	abandoned well reclamation	area-wide	site inspection	operations conducted in compliance with permit	minimum of once and as necessary until reclamation complete	violation of regulations, change from approved permit, unnecessary or undue degradation	issue an INC/certified letter requiring proper operator rehabilitation

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PALEONTOLOGY	significant paleontological localities, ACECs	area-wide	inspection of area disturbed	degradation caused by human or natural activities that lead to loss of significant fossil resources	once yearly	loss or damage to significant fossil resources	closure of areas surrounding site to prevent further disturbance to significant fossil resources
RECREATION	general recreation use	area-wide with emphasis on dispersed use of undeveloped recreation sites	area inspections to look for vandalism, resource abuse, and install photo points	site condition	biannual (June and October); photograph annually	user conflicts, resource degradation, or safety hazards	avoid location of oil and gas facilities in undeveloped recreation sites having concentrated use, and coordinate timing of exploration activities to minimize conflicts during peak periods of use
	concentrated recreation use	special recreation management areas, sites with recreation facilities	visitor registration, traffic counters estimates, photo points	visitor days, site condition	visitor registration boxes, counters checked once monthly at the minimum, weekly or biweekly during heavy use periods, photograph annually	increased visitor use per year or sustained use that requires additional or improved facilities	avoid location of oil and gas facilities in developed recreation sites having concentrated use, and coordinate timing of exploration activities to minimize conflicts during periods of use
		area-wide commercial, competitive activities	administrative review, site inspection for complexes with permit stipulations	permit stipulations, resource condition success of reclamation	on site during competitive events, periodic site inspection for commercial operations, administrative review annually	irreparable resource damage, compromise of visitor safety, recreation experience	avoid location of oil and gas facilities in areas where know commercially permitted recreation activities are occurring and coordinate timing of exploration activities to minimize conflicts during peak periods of use

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SOILS	soil erosion, uplands	area-wide where management activities are occurring or expected to occur	visual observation and surveyed erosion pins	soil loss in tons per acre	site will be visually examined quarterly. Where erosion is deemed excessive, measurements of site characteristics will be taken to determine rate of soil loss.	visual evidence of rill, gully, or sheet erosion. Loss of soil exceeding 10 tons per acre	report exceedance to BLM, MDEQ, or EPA. If caused by CBM discharge or activities, enforcement action will be taken.
	soil erosion, streambank, and floodplain	area-wide along rivers and tributaries where management activities are occurring or expected to occur	visual observation and surveyed erosion pins	area effected in square feet or acres	site will be visually examined quarterly. Where streambank erosion is deemed excessive, measurements of site characteristics will be taken to determine soil loss.	a 10% increase in streambank loss	report exceedance to BLM, MDEQ, or EPA. If caused by CBM discharge or activities, enforcement action will be taken.
	soil salinization	area-wide where management activities are occurring or expected to occur	visual observation, measurement of soil characteristics such as pH, EC, SAR	area effected in square feet or acres	site will be visually examined quarterly. Where salinity levels show an increase because of vegetation or soil effects, measurements of site characteristics will be taken to determine salinity levels.	a 20% increase in conductivity levels	report exceedance to BLM, MDEQ, or EPA. If caused by CBM discharge or activities, enforcement action will be taken.
	compaction	areas effected by extraction activities	penetrometer or visual inspection	pounds per square inch	1 to 2 times yearly	10% increase in density	limit or block access to compacted sites

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VEGETATION							
	ecological status	areas affected by disturbance through the pre-production, production, post-production processes	ecological site method in key areas	composition, production compared to potential natural community for each site	pre-development ecological status baseline data	status is reduced by 15% or a drop in class	ecological site integrity will be altered to increase status of ecological site index by 15% or an increase in ecological class
	trend	areas affected by disturbance through the pre-production, production, post-production processes	any suitable methods as described in TR 4400-4 or the National Range Handbook	apply to the technique selected, may include number of individuals per unit area, percent cover, percent frequency, or percent species composition	every 3 to 5 years after the collection of ecological status baseline data	a change in the direction of trend away from management	measure implementation of action put forth to mitigate reduction of ecological status using techniques listed in monitoring appendix for vegetative trend
Noxious Weeds	trend	areas affected by disturbance through the pre-production, production, post-production processes	Montana Noxious Weed Standards	acres, plants per square feet, species	yearly (through post production reclamation)	10% increase beyond objectives for the area/new species occurrence or infestation	operators will be required to contain and suppress noxious weeds. Conservation measures will be required in noxious weed sites to decrease population of noxious weeds and increase population of native plant community

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Riparian/ Wetlands	condition, trend, age class structure, streambank alteration	any federal action (including split estate)	photo plot, estimate key areas by sight inspection, Cole Browse Method, Key Forage Method, other methods found in Technical References (TR4400-3, TR4400-4, TR4400-7, TR1737-3, TR1737-8, TR1737-9) including MRWA (Montana Riparian Wetland Association) Riparian Inventory for areas not previously inventoried MRWA PFC on inventory areas	percent species composition, percent in each age class, percent utilization, height, percent of the streambank	based on activity plan schedule- a minimum of once every 5 years	trend away from objective or when no improvement occurs, in unsatisfactory habitat condition/functioning at risk with downward trend	oil and gas operators will be required to alter activities in order to provide environmental factors for increasing functionality or habitat conditions of the streams/wetlands. Oil and gas operators may be required to develop replacement wetlands in order to compensate for overall loss of wetlands according to Section 404 of Clean Water Act.
Special Status and Threatened and Endangered (T&E) Plant Species	condition	areas affected by disturbance through the pre-production, production, post-production processes	Montana Natural Heritage Program and visual inspection	presence and condition	once during the growing season, at a minimum	downward trend in plant condition caused by oil and gas activities	oil and gas operators will be required to alter their activities in order to benefit special status or T&E plant species
WILDLIFE (see also "Wildlife Monitoring and Protection Plan)							
Aquatic Biological Diversity (flora/fauna)	population diversity	intermittent/perennial streams associated with produced water discharge	stream sampling	diversity index	every 3 years	downward trend overall stream biological diversity	reduction or elimination of untreated produced water into drainage or watershed
Big Game	seasonal habitat use	project area plus 1-mile buffer	air/ground field inspection	occupancy	annually	downward trend in habitat occupancy	extension of timing stipulations or conditions of approval, off-site habitat management or enhancement

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Black-footed Ferret	occupancy	prairie dog towns larger than 80 acres located within 0.5 mile of proposed activity	ground inspection	occupancy	determined on a site-specific basis in coordination with U.S. Fish and Wildlife Service (FWS)	habitat decline or prairie dog fatalities caused by oil and gas activities - occupancy of black-footed ferrets would be managed in a Black-Footed Ferret Management Plan	no incidental take; reinitiate consultation if new information shows it may be effected
Burrowing Owl	active nest locations	specific project area plus 0.5-mile buffer (within active prairie dog town)	ground inspection	occupancy	twice yearly (June to August)	human-caused disturbance to owls related to oil and gas activities such as vandalism and harassment	extension of timing and/or increase of distance from nest; stipulations or conditions of approval
Grey Wolf	occupancy	Billings RMP area	air/ground field surveys	number of sitings	annually until reintroduction objectives are met	1- to 3-year downward trend in production or occupancy	no incidental take; reinitiate consultation if new information shows it may be effected
Migratory Non-game Birds	occupancy	project area plus 0.25-mile buffer	ground observations	occupancy	periodically	documented fatalities caused by oil and gas activities	refinements in infrastructure planning (project plans), implementation of travel corridors, enhanced reclamation standards, and off-site habitat management or enhancement

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Mountain Plover	active nest locations	specific project area plus 0.5-mile buffer (within areas less than 4-inch average vegetation height and prairie dog towns)	ground inspection	occupancy	twice yearly (April 15 to June 30)	human-caused disturbance to mountain plovers related to oil and gas activities such as vandalism and harassment	BLM received an exemption from the prohibitions of Section 9 of ESA regarding take by agreeing to terms and conditions in biological opinion (BO). Incidental take of habitat and individuals allowed up to level stated in BO. Take must be monitored. Reinitiation of Section 7 will occur before allowable take is exceeded.
Prairie Dog	active prairie dog colony	specific project area plus 0.5-mile buffer	air/ground inspection	occupancy	annually	documented prairie dog fatalities caused by oil and gas activities	establishment of no surface occupancy zones and/or establishment of timing restrictions within prairie dog towns
Raptors	active nest locations (excluding burrowing owls)	project area plus 1-mile buffer	air/ground field inspection	number of nests	every 3 years	downward trend in occupancy	extension of timing and/or increase in distance from nest; stipulations or conditions of approval
	raptor productivity (including Burrowing owl)	active nests within 1-mile of project disturbance plus 1-mile buffer	air/ground field inspection	nest success/failure species productivity	annually	downward trend in nest success, overall productivity	extension of timing and/or increase in distance from nest; stipulations or conditions of approval
	raptor productivity-selected undeveloped comparison area	project area	air/ground field inspection	nest success/failure species productivity	every 5 years	information used as support to determine downward trend	extension of timing and/or increase in distance from nest; stipulations or conditions of approval

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Sage Grouse	sage grouse lek location	CBM overall project area	aerial field inspection	number, location of leks	every 5 years	downward trend in habitat occupancy	extension of timing and/or increase in distance from lek; stipulations or conditions of approval; off-site habitat management/mitigation
	sage grouse lek attendance	specific project development areas plus 2-mile buffer	air/ground field inspection	number of males/lek	annually	downward trend in lek attendance	extension of timing and/or increase in distance from lek; stipulations or conditions of approval; off-site habitat management/mitigation
	sage grouse winter habitat	project area plus 2 mi. buffer	air/ground field inspection	occupancy	annually	downward trend in habitat occupancy or quality caused by oil and gas activities	extension of timing and/or increase in distance from lek; stipulations or conditions of approval; off-site habitat management/mitigation
Special Status Species (BLM and Montana Natural Heritage Program lists)	occupancy	specific project area plus 1-mile buffer	ground field inspection	occupancy	annually at a minimum via species habitat requirements	downward trend in habitat occupancy or quality caused by oil and gas activities	establishment of timing and/or distance from breeding area through stipulations or conditions or approval
Threatened, Endangered and Proposed Species other than previously described	occupancy, productivity	CBM overall project area	air/ground field inspection	occupancy	determined on a site-specific basis in coordination with FWS	habitat decline or fatalities caused by oil and gas activities; occupancy of species would be managed in a site-specific Management Plan	reinitiate section 7 consultation with FWS